

A Novel UAS-Borne Miniature Sensor System to Measure the Size and Composition of Volcanic Ash, Phase I

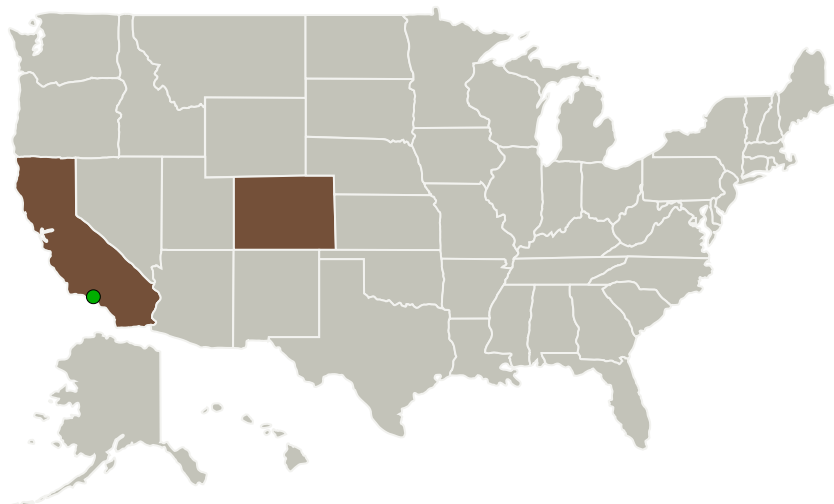
Completed Technology Project (2012 - 2012)



Project Introduction

The explosive eruption of a volcano under the Eyjafjallajökull glacier in Iceland on 14 April 2010 brought air travel in Europe and across the Atlantic to a standstill. Millions of passengers were stranded for over a week and the shutdowns cost the airlines \$200 million per day. Jet airliner encounters with volcanic ash plumes have resulted in 90 known incidents of damage to engines and airframes over the past 30 years. Research aircraft measurements from the Mt. St. Helens eruption in 1980 showed that particles with diameters < 0.1 micron were found in concentrations similar to those measured in ambient air, but concentrations with diameters from 0.1 to 30 microns were up to 100 times greater than in ambient air. A safe and cost-effective alternative to flying conventional research aircraft into volcanic ash plumes is to instrument a small Unmanned Aerial System (UAS) that uses electric motor propulsion. In Phase I we propose to design and laboratory test a novel, standalone sensor system that can measure the particle size distribution from 0.09 micron to hundreds of microns, record high-resolution digital images, and collect samples for post-analysis of the composition of volcanic ash. In Phase II we will install the sensor package on a tethered balloon and a small electric-powered UAS supplied by Vanilla Aircraft LLC. In concert with experts from the University of Alaska and the University of Costa Rica, we will perform a pilot field project measuring ash size distribution, recording high-resolution digital images, and analyzing ash composition in the plume of an active volcano in Costa Rica.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
SPEC, Inc.	Lead Organization	Industry	Boulder, Colorado
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Colorado

Project Transitions

**January 2012:** Project Start**July 2012:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137917>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

SPEC, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

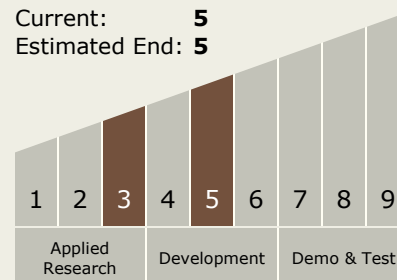
Carlos Torrez

Principal Investigator:

Ralph P Lawson

Technology Maturity (TRL)

Start: 3
Current: 5
Estimated End: 5



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.3 Mechanical Systems
 - └ TX12.3.4 Reliability, Life Assessment, and Health Monitoring

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System